WHAT IS CLAIMED IS:

1. A method of forming an insulating film for a semiconductor device for forming, on a semiconductor layer exposed on a substrate, said insulating film through a reaction between at least oxygen and a semiconductor, comprising the steps of:

(a) loading said substrate including said semiconductor layer in a processing chamber; and

(b) generating, within the processing chamber, plasma biased toward said substrate with the processing chamber kept in an atmosphere including oxygen, and subjecting said semiconductor layer to the biased plasma.

2. The method of forming an insulating film of Claim 1, wherein a thickness of said insulating film is controlled by adjusting a degree of biasing the plasma in the step (b).

3. The method of forming an insulating film of Claim 1, wherein the step (b) is carried out at a temperature of 300℃ or less.

4. The method of forming an insulating film of Claim 3, wherein the step (b) is carried out at a temperature of 200℃ or less.

5. The method of forming an insulating film of Claim 4, wherein the step (b) is carried out with a photoresist film formed on said substrate.

6. The method of forming an insulating film of Claim 1, wherein said insulating film is a gate insulating film of

a MIS transistor.

7. The method of forming an insulating film of Claim 6, further comprising, before at least the step (b), a step of forming a first active region doped with an impurity of a first conductivity type and a second active region doped with an impurity of a second conductivity type,

wherein a first insulating film and a second insulating film are respectively formed on said first active region and said second active region in the step (b).

8. The method of forming an insulating film of Claim 1, further comprising, after the step (b), a step of conducting a heat treatment on said insulating film.

9. The method of forming an insulating film of Claim 1, wherein the step (b) is carried out in an atmosphere including nitrogen and oxygen.

10. The method of forming an insulating film of Claim 9, wherein the step (b) is carried out in an atmosphere including a NO gas, namely, a nitriding oxidation atmosphere.

11. The method of forming an insulating film of Claim 9, wherein the step (b) is carried out in an atmosphere including oxygen and N_2, namely, a nitriding oxidation atmosphere.

12. The method of forming an insulating film of Claim 1, wherein the step (b) is carried out in an atmosphere including O_2 but substantially no nitrogen.

13. A method of fabricating a semiconductor device comprising

the steps of:

(a) forming an insulating film on first and second active regions of a semiconductor substrate;

(b) forming a first photoresist film covering said second active region and having an opening on said first active region;

(c) implanting impurity ions into said first active region through said first photoresist film;

(d) removing said first photoresist film;

(e) recovering a thickness of said insulating film by subjecting, in an atmosphere including oxygen, said semiconductor substrate to plasma biased toward said semiconductor substrate;

(f) forming a second photoresist film covering said first active region and having an opening on said second active region; and

(g) implanting impurity ions into said second active region through said second photoresist film.

14. The method of fabricating a semiconductor device of Claim 13,

wherein the step (c) corresponds to impurity ion implantation for controlling a threshold value of a MISFET.

15. A method of fabricating a semiconductor device comprising the steps of:

(a) forming a semiconductor film on a semiconductor substrate;

(b) forming, on said semiconductor film, a first photoresist

film covering a first part of said semiconductor film and having an opening on a second part of said semiconductor film adjacent to said first part, and implanting impurity ions of a first conductivity type into said semiconductor film through said first photoresist film;

(c) after removing said first photoresist film, forming a second photoresist film covering said second part of said semiconductor film and having an opening on said first part, and implanting impurity ions of a second conductivity type into said semiconductor film through said second photoresist film;

(d) removing said second photoresist film; and

(e) forming an insulating film on said semiconductor film through a reaction between at least oxygen and a semiconductor by subjecting, in an atmosphere including oxygen, said semiconductor substrate to plasma biased toward said semiconductor substrate.

16. The method of fabricating a semiconductor device of Claim 15, further comprising, before the step (a), a step of forming gate insulating films respectively on a first conductivity type MISFET formation region and a second conductivity type MISFET formation region of said semiconductor substrate,

wherein said semiconductor film is formed on said gate insulating films over said first and second conductivity type MISFET formation regions in the step (a),

said first part corresponds to said second conductivity type

MISFET formation region and said second part corresponds to said first conductivity type MISFET formation region in the steps (b) and (c), and

the method further includes, after the step (d), a step of patterning said semiconductor film into a gate electrode of a dual gate type over said first conductivity type MISFET formation region and said second conductivity type MISFET formation region.

17. The method of fabricating a semiconductor device of Claim 15, further comprising, after at least the step (d), a step of siliciding an upper portion of said semiconductor film after removing at least part of a thickness of said insulating film formed in the step (e).

18. A method of fabricating a semiconductor device comprising the steps of:

(a) forming an insulating film on a semiconductor substrate;

(b) forming a semiconductor film on said insulating film;

(c) forming a gate electrode of a MISFET and exposing a portion of said insulating film disposed below part of said semiconductor film by patterning said semiconductor film by etching with a photoresist film used as a mask; and

(d) oxidizing etching residues of said semiconductor film remaining on said exposed insulating film by subjecting, in an atmosphere including oxygen, said semiconductor substrate to plasma biased toward said semiconductor substrate, with keeping said photoresist film.

19. The method of fabricating a semiconductor device of Claim 18, further comprising, after the step (d), steps of:

removing said oxidized etching residues and an exposed portion of said insulating film; and

siliciding part of said semiconductor substrate exposed by removing said exposed portion of said insulating film.

20. The method of fabricating a semiconductor device of Claim 18,

wherein the step (d) is carried out at a temperature of 200℃ or less.

21. A method of fabricating a semiconductor device comprising the steps of:

(a) successively depositing a first insulating film and a conducting film at least including a metal on a semiconductor substrate;

(b) patterning said conducting film and said first insulating film by etching with a photoresist film used as a mask into a gate electrode and a gate insulating film;

(c) forming a second insulating film on at least an exposed portion of said semiconductor substrate through a reaction between oxygen and a semiconductor by subjecting, in an atmosphere including oxygen, said semiconductor substrate to plasma biased toward said semiconductor substrate, with said photoresist film kept;

(d) removing said photoresist film; and

(e) forming source/drain regions by introducing an impurity into regions positioned on both sides of said gate electrode in said semiconductor substrate.

22. The method of fabricating a semiconductor device of Claim 21,

wherein a polysilicon film and a metal film stacked thereon are formed as said conducting film in the step (a),

a bottom electrode of a polysilicon film and a top electrode of a metal film are formed as said gate electrode in the step (b), and

said second insulating film is formed also on side faces of said bottom electrode in the step (c).

23. The method of fabricating a semiconductor device of Claim 22,

wherein a silicon nitride film is further formed on said conducting film in the step (a),

an over-gate protection film of a nitride film is formed on said top electrode in the step (b), and

the method further includes, after the step (d), steps of:

(f) forming nitride film sidewalls on side faces of said polysilicon film and said metal film;

(g) depositing an interlayer insulating film of a silicon oxide film on said substrate; and

(h) forming a contact hole penetrating through said interlayer insulating film and reaching said source/drain region

in a self-alignment manner against said gate electrode.

24. The method of fabricating a semiconductor device of Claim 21,

wherein the step (c) is carried out at a temperature of 200℃ or less.

25. A method of fabricating a semiconductor device comprising the steps of:

(a) forming a first gate electrode from a semiconductor film including an impurity of a first conductivity type on a first conductivity type MISFET formation region of a semiconductor substrate with a first gate insulating film sandwiched therebetween, and forming a second gate electrode from a semiconductor film including an impurity of a second conductivity type on a second conductivity type MISFET formation region of said semiconductor substrate with a second gate insulating film sandwiched therebetween;

(b) forming a coat insulating film through a reaction between at least oxygen and a semiconductor on said semiconductor substrate and exposed portions of said first and second gate electrodes by subjecting, in an atmosphere including oxygen, said semiconductor substrate to plasma biased toward said semiconductor substrate;

(c) forming source/drain regions of a first conductivity type MISFET through ion implantation of an impurity of the first conductivity type by using, as masks, a first photoresist film covering said second conductivity type MISFET formation region

and having an opening on said first conductivity type MISFET formation region and said first gate electrode;

(d) removing said first photoresist film; and

(e) forming source/drain regions of a second conductivity type MISFET through ion implantation of an impurity of the second conductivity type by using, as masks, a second photoresist film covering said first conductivity type MISFET formation region and having an opening on said second conductivity type MISFET formation region and said second gate electrode.

26. The method of fabricating a semiconductor device of Claim 25,

wherein the step (b) is carried out at a temperature of 300℃ or less.

27. The method of fabricating a semiconductor device of Claim 25,

wherein said first photoresist film is removed in the step (d) by ashing with a degree of biasing plasma smaller than a degree of biasing the plasma in the step (b).

28. A method of fabricating a semiconductor device comprising the steps of:

(a) successively depositing a pad oxide film and a masking nitride film on a semiconductor substrate;

(b) forming an opening in said masking nitride film and said pad oxide film in a position corresponding to a trench formation region;

(c) forming a trench in said semiconductor substrate by conducting etching with said masking nitride film used as a mask;

(d) forming a rounding insulating film through a reaction between at least oxygen and a semiconductor on a portion of said semiconductor substrate exposed within said trench by subjecting, in an atmosphere including oxygen, said semiconductor substrate to plasma biased toward said semiconductor substrate; and

(e) forming a trench isolation region by filling said trench with an insulating film.

29. The method of fabricating a semiconductor device of Claim 28, further comprising, after the step (d) and before the step (e), a step of increasing a thickness of said rounding insulating film by thermal oxidation.

30. The method of fabricating a semiconductor device of Claim 28,

wherein the step (d) is carried out at a temperature of 300℃ or less.